ERDC/CERL TR-11-38

US Army Corps
of Engineers®
Engineer Research and
Development Center

Installation Technology Transfer Program

Integration of Sustainment Management Systems (SMS) with the Army Installation Status Report for Infrastructure (ISR-I)

Michael N. Grussing, Kelly M. Dilks, and Matthew C. Walters

September 2011

Construction Engineering
Research Laboratory

Installation Technology Transfer Program

ERDC/CERL TR-11-38
September 2011

Integration of Sustainment Management Systems (SMS) with the Army Installation Status Report for Infrastructure (ISR-I)

Michael N. Grussing, Kelly M. Dilks, and Matthew C. Walters

Construction Engineering Research Laboratory
U.S. Army Engineer Research and Development Center
2902 Newmark Drive
Champaign, IL 61822

Final report

Prepared for Office of the Assistant Chief of Staff for Installation Management (ACSIM)
Arlington, VA 22202

Under Project FY10-12E, "SMS-ISR Integration"

Abstract: This report describes the process for integrating the BUILDER Sustainment Management System (SMS) with the US Army Installation Status Report for Infrastructure (ISR-I). A common building component and assessment data framework between SMS and ISR-I was developed to link local facility condition and functional requirements managed through the BUILDER Sustainment Management System (SMS) to enterprise-level quality and mission metrics reported in the ISR-I. To accomplish this, the applicable facility components for all 63 ISR-I rating standards booklets were mapped to the corresponding BUILDER inventory items based on the UniFormat II classification system (ASTM E 1557-02). This data framework enables BUILDER to extract condition and functionality data from the ISR-I for certain building systems and components. It also establishes a foundation for uploading quality and mission capability ratings to the ISR-I for facilities that have been assessed using BUILDER. The outcome is a higher level of interoperability between the BUILDER SMS and ISR-I systems. BUILDER can use ISR-I condition data to drive the development of local installation annual work plans, and BUILDER-generated condition indices can feed ISR-I reporting requirements.

Executive Summary

The Installation Status Report for Infrastructure (ISR-I) is the US Army's strategic-level process for assessing the condition, performance, and readiness of facilities. ISR-I facility-related mission and quality criteria are compiled and organized by component type, and published as a series of 63 rating standards booklets. Each booklet represents a major, mission-based Army facility group that encompasses one or more Facility Category Groups (FCGs). Each criterion is associated with a qualitative color scale (Red, Amber, Green) that includes narrative descriptors. These ratings are combined to determine the general status of a facility or group of facilities at an installation.

The BUILDER Sustainment Management System (SMS) supports effective and efficient management of building component inventory information; condition and readiness reporting; and Sustainment, Restoration, and Modernization (SRM) facility investments. BUILDER functions as a web-accessible enterprise system that provides asset recordkeeping, condition-analysis capabilities, and decision-support information to Department of Public Works personnel responsible for a large building portfolio. Implementation of BUILDER allows facility managers to see critical building condition information aggregated in one location, accessible through a user-friendly computer interface. BUILDER has life-cycle analysis capabilities to perform work identification at the local installation level, but also can feed information to the ISR-I in support of higher-level reporting.

The objective of this project was to integrate BUILDER with the ISR-I by creating a data structure that both can use to exchange information and extend the benefits of each other. This data structure links local, tactical-level facility condition and functional requirements identified and managed through BUILDER to the strategic-level quality and mission metrics reported in the ISR-I for use by headquarters elements. Individual ISR-I facility elements were linked to the corresponding BUILDER inventory items using the UniFormat II building element classification standard (ASTM E 1557-02). In addition, the ISR-I color ratings were mapped as applicable to SMS Condition Index (CI) scales related to facility quality or the Functionality Index (FI) related to facility capability. This linkage provides a way for BUILDER to extract ISR-I condition and functionality data

for certain building systems where applicable. It also provides a foundation for providing quality and mission capability ratings to populate ISR-I when a BUILDER-based assessment has been performed.

Benefits

By linking the two systems, BUILDER improves the utility of the ISR-I for decision support to local installation facility managers. ISR-I information can populate BUILDER facility data, thus lowering SMS implementation costs. The benefit of this approach is the minimizing of time required to initially populate the BUILDER database with inventory information that interfaces readily with ISR-I quality criteria. In addition, ISR-I facility rating information is collected electronically to feed BUILDER component condition ratings while simultaneously accomplishing basic ISR-I inspection requirements. The outcome is a higher level of interoperability between the BUILDER SMS and the ISR-I. BUILDER can use ISR-I-populated condition data to drive the development of local installation annual work plans, and the BUILDER-generated CI can help to satisfy ISR-I reporting requirements.

Costs

The initial implementation costs for BUILDER are primarily accounted for by the collection of facility inventory data and subsequent condition information. However, the direct link with existing ISR-I data can significantly reduce this initial implementation cost. This is accomplished through the data mapping framework developed for this project. While ISR-I information may be less detailed than a full BUILDER implementation, the effort needed to initially populate BUILDER from ISR-I data is negligible. After that initial step, more detailed information can be added to BUILDER as needed to refine facility inventory, condition assessments, or a project scope as the information becomes available. Consequently, installations are able to start recognizing the benefits of BUILDER without significant costs above the required ISR-I inspection effort.

Implementation and maintenance

With the linkage of BUILDER and the ISR-I, maintenance of the data in BUILDER is accomplished during the normal ISR-I inspection cycle. It may be done by in-house personnel, as is currently the case, or assessments may be contracted out. As always, proper training is required to en-

sure accurate and consistent inspection, data collection, data entry, system analysis, and report generation.

A catalog of building templates for each of the 63 ISR-I rating standards booklet types has been created in BUILDER to match the ISR-I component data structure. Once a set of buildings has been populated in BUILDER based on the Army's real property inventory, system and component inventories for these buildings are rapidly created in BUILDER by applying these templates. This allows life-cycle information to be stored on these buildings in addition to the general condition data provided in ISR-I.

Recommendation

It is recommended that the standardized ISR-I template models developed for BUILDER be expanded in the future to provide more detail based on the Army's facility category groupings (FCGs), Army Facility Standards and Standard Designs, and refined quantities, material types, and equipment types.

This project demonstrated the capability to import information from the ISR-I database to populate the BUILDER database. However, with its detailed, objective assessment techniques and work requirement identification capability, BUILDER information could also feed into ISR-I using the data mapping method developed for this project. Therefore, it is recommended that an automated import process be developed for ISR-I to make this data exchange possible to further streamline the facility management process. To accommodate this development, BUILDER technology should be further integrated within the Army's Facility Management Enterprise Framework, including systems in addition to ISR-I such as the Headquarters Installation Inventory System (HQIIS), Army Mapper, Computerized Maintenance Management Systems (CMMS), and General Fund Enterprise Business System (GFEBS).

Table of Contents

List of Figures and Tables

Figures

Tables

Preface

This study was conducted for the US Army Assistant Chief of Staff for Installation Management (ACSIM) under Installation Technology Transfer Program (ITTP) Project ITTP FY10-12E, "SMS-ISR Integration." The technical reviewer for ACSIM was Philip Columbus, DAIM-ODF.

The work was performed by the Engineering Processes Branch (CF-N) of the Facilities Division (CF), US Army Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL). The ITTP Program Manager was Debbie J. Lawrence, CEERD-CV-ZT. At the time of publication, Donald K. Hicks was Chief, CEERD-CF-N; L. Michael Golish was Chief, CEERD-CF; and Martin J. Savoie was the Technical Director for Installations, CEERD-CV-ZT. The Deputy Director of ERDC-CERL was Dr. Kirankumar Topudurti and the Director was Dr. Ilker Adiguzel.

COL Kevin J. Wilson was the Commander and Executive Director of ERDC, and Dr. Jeffery P. Holland was the Director.

Unit Conversion Factors

Multiply	By	To Obtain
Acres	4,046.873	square meters
cubic feet	0.02831685	cubic meters
cubic inches	0.00001638706	cubic meters
degrees (angle)	0.01745329	radians
degrees Fahrenheit	(5/9) x (°F – 32)	degrees Celsius
degrees Fahrenheit	(5/9) x (°F – 32) + 273.15.	kelvins
Feet	0.3048	meters
gallons (U.S. liquid)	0.003785412	cubic meters
horsepower (550 ft-lb force per second)	745.6999	watts
Inches	0.0254	meters
kips per square foot	47.88026	kilopascals
kips per square inch	6.894757	megapascals
miles (U.S. statute)	1.609347	kilometers
pounds (force)	4.448222	newtons
pounds (force) per square inch	0.006894757	megapascals
pounds (mass)	0.4535924	kilograms
square feet	0.09290304	square meters
square miles	2,589,998	square meters
tons (force)	8,896.443	newtons
tons (2,000 pounds, mass)	907.1847	kilograms
Yards	0.9144	meters

1 Introduction

1.1 Background

The US Army Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL) has developed Sustainment Management System (SMS) technology that provides installations a decision-support tool for sustainment, restoration, and modernization (SRM) investments. The SMS approach supports integrated facility management, including inspection, maintenance/repair/recapitalization planning, recordkeeping, and reporting. It allows facility managers to measure condition changes, manage life-cycle costs, and focus attention and resources on mission-critical assets that provide the best value to the Army.

Implementation of the BUILDER* SMS for a building or a group of buildings starts with the creation of building system and component inventory information. The data are stored, managed, and accessed in a central location on the web. Each building component is identified and categorized, and attribute information (including types, materials, quantities, and construction dates) is recorded. BUILDER uses this inventory information to associate key life-cycle attributes, including replacement costs, expected service lives, and component importance factors. Based on this initial system component inventory information, condition life-cycle trends for each component are projected to model expected degradation over time.

Once the facility component inventory is developed, standardized inspections can be conducted on these components to determine an objective and repeatable Condition Index (CI) measure that communicates the general physical health of the asset. The CI is determined by one of two standardized processes:

- direct surveys for cursory rating of component condition
- distress surveys for more detailed information about the type of distress, severity, and the amount negatively affecting building components.

* BUILDER is a registered trademark of Headquarters, Department of the Army, Washington, DC.

The two-tiered inspection process allows for transition to more detailed inspection modes as conditions warrant, thus allocating inspection resources more appropriately. The list of distresses in a distress survey are finite, and are directly linked to condition deduct curves developed in consultation with building subject matter experts. Thus, the collection of this standardized distress information produces a quantitative CI metric that models the rating expected from a group of experts. The direct rating procedure also uses standardized condition observations, and results in a CI metric that is correlated to the distress survey results. In addition to condition assessments, which include deterioration-based performance effects, functionality-based assessments can address obsolescence-based impact on energy costs, user requirements, and code compliance issues such as accessibility for disabled people. This assessment process provides a comprehensive picture of overall building performance (condition and functionality) over time. From this life-cycle condition and functionality information, both short-term and long-range facility plans can be developed. For each year, BUILDER generates a flexible list of work recommendations based on standards and policies applied across all assets. This comprehensive process ensures that the installation can maintain facilities at common levels based on mission requirements.

The Installation Status Report for Infrastructure (ISR-I) is the tool used by Army installations to report the condition and readiness of their facility assets. Building tenants are primarily responsible for providing a condition/readiness rating based on standardized guidelines that consider several different aspects of the facility. This process results in a general Green, Amber, or Red qualitative rating for each facility, which eventually gets rolled up by building category code (CATCODE). This strategically focused process is inexpensive to implement, but it is also subjective and it does not link to actual building component work needs at a tactical installation level. While the overall ISR-I process is expected to be the main means of collecting facility rating data for the foreseeable future, BUILDER can produce valuable input for the ISR-I. Heating, ventilation, and air conditioning (HVAC) system CI values derived from the BUILDER rating process can, for example, be used to populate the HVAC component of ISR-I. This approach would result in a more objective condition rating for applicable aspects of the facility while providing a direct linkage to equipment work needs.

1.2 Objective

The objectives of this demonstration project were to (1) create a data map between BUILDER SMS and ISR-I components common to both systems, (2) provide a way to exchange required facility information between BUILDER and ISR-I, and (3) develop facility data structure template for BUILDER that supports ISR-I data.

1.3 Approach

The work involved creating a linkage between data elements common to both BUILDER and ISR-I. To accomplish this, the individual ISR-I facility elements were linked to their corresponding BUILDER inventory items based on the UniFormat II classification system (ASTM E 1557-02). In addition, ISR-I color ratings (i.e., Green, Amber, and Red) were mapped either to the SMS CI scale related to facility quality or the Functionality Index (FI) scale related to facility capability. These linkages provide a way for BUILDER to extract ISR-I data for certain building systems where applicable. They also serve as a foundation for providing quality/mission capability ratings to help complete the ISR-I assessment when a BUILDER-based assessment has been performed.

1.4 Mode of technology transfer

The BUILDER SMS is a product of Army research in asset management, facility investment, and building condition assessment. This project transfers the technology encompassed in the BUILDER program to the Army installation Departments of Public Works (DPW) for eventual use in building asset life-cycle management and sustainment. In addition, this project makes BUILDER technology interoperable with the ISR-I to the benefit of both user communities.

2 Linking BUILDER to ISR-I Criteria

2.1 Data framework description

ISR-I rating criteria are published as a series of rating standards booklets, as specified in Army Regulation AR 210-14, para 1-4.g, organized according to designated facility category groups (see Appendix A). These booklets provide a uniform framework within which specific requirements can be tailored for each facility group. Rating standards booklets are organized by facility components, and each component may have one or more elements assigned to it. For example, a typical component is a Unit Operations Building, which is addressed in Booklet 19 (Appendix B). Elements of this facility type include floors, walls, doors, computer network systems, pavements, and landscaping.

Rating criteria are associated with each element. These criteria are divided into one of two categories: (1) quality rating criteria and (2) mission rating criteria. *Quality criteria* measure the general health of the building. Physical deterioration of the building due to normal aging, excessive or abusive use, or poor maintenance causes a reduction in facility quality. *Mission criteria* (sometimes called *functional criteria*) measure the inherent suitability for providing services for the functions or mission that the facility is required to support. Mission functional degradation results from inefficient building layout, improper choice of materials or equipment, or code violations that affect the building's ability to perform mission and meet user requirements.

The ISR-I facility components are designated either as (1) common components or (2) facility-specific components. *Common components* are generally present in all buildings, and may include site and grounds, foundations, roofing, etc. *Facility-specific components* are usually associated mainly with mission criteria, and are specific requirements for a particular facility type (for example, an overhead crane in a Vehicle Maintenance Facility).

To create a data linkage with BUILDER, all common components and subordinate elements from the ISR-I booklets were mapped to the BUILDER component-section hierarchy. This mapping is illustrated conceptually by the example shown in Figure 1.

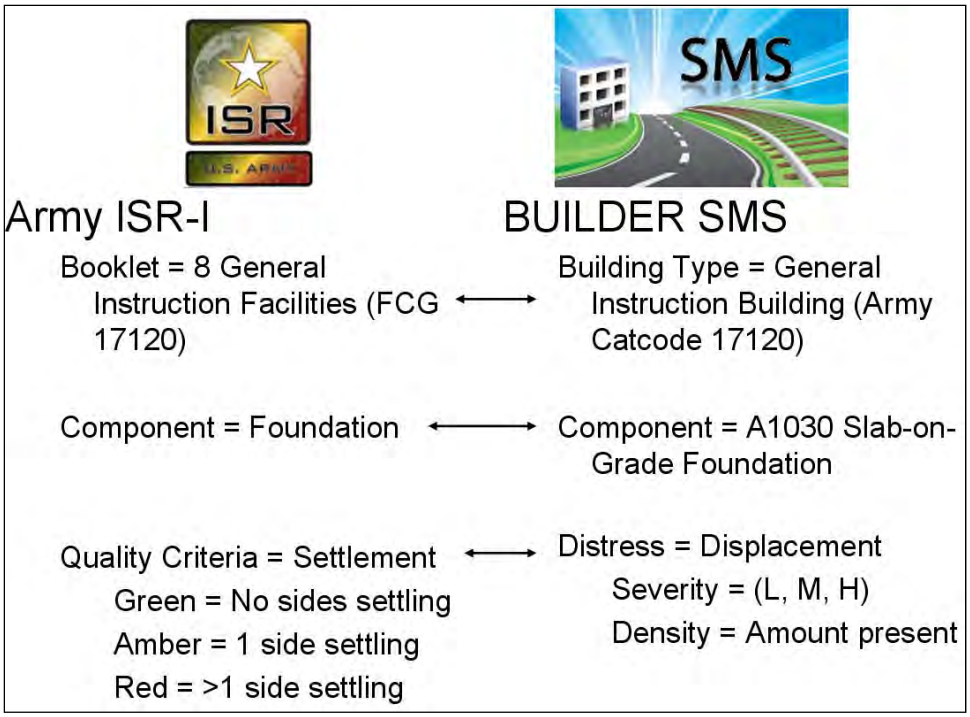


Figure 1. Data relationship between Army ISR-I and BUILDER SMS.

2.2 BUILDER-ISR-I data map

While ISR-I is designed to provide information about the state and readiness of facilities at a macro level for an installation, the BUILDER SMS is designed to provide localized information down to the individual facility level, and even systems and components within that facility. This design provides specific SRM work requirements for life-cycle planning and execution. Because of this difference in objective, and BUILDER's focus toward repair work planning, the BUILDER facility hierarchy is arranged somewhat differently than in the ISR-I. BUILDER classifies the systems and components in an individual facility using the Uniformat II hierarchy (ASTM E 1557-02), a standardized classification for building elements.

In BUILDER, the facility is organized into its constituent systems and components. For each component, a material or equipment category is assigned, as well as a section name that typically describes the location of the component in the building. A particular component type, such as interior walls, can have multiple "component-sections" that designate the unique instance of its material and location. This is used to link key life-cycle attributes to the component-section that BUILDER uses in its analysis. In establishing the linkage map between BUILDER and ISR-I. A unique

component-section hierarchy is created. This mapping for a single ISR-I element is illustrated in Table 1.

Table 1. Example mapping of ISR-I elements.

ISR-I	BUILDER
Component: Administrative Space	Component: C3010 Interior Wall Finishes
Element: Walls	Type: CMU Block, Drywall, Other
Criteria: Green, Amber, Red	Section Name: Administrative Space

This linkage process was completed for each of the 63 ISR-I rating standards booklets, with a total of more than 3,800 unique component sections created for this purpose. The list of component sections for Booklet 19, Unit Operations Building, is shown as an inventory data template in Appendix C.

2.3 Implementation as BUILDER templates

To rapidly replicate this component-section hierarchy in BUILDER to match the ISR-I data structure, the data map discussed above was implemented using the Building Templates feature in BUILDER. There is one template for each of the 63 ISR-I booklet types, and each template contains the specific components and elements as described in the booklet. Figure 2 shows a screen capture of the template created for Booklet 19, which covers Unit Operations Buildings.

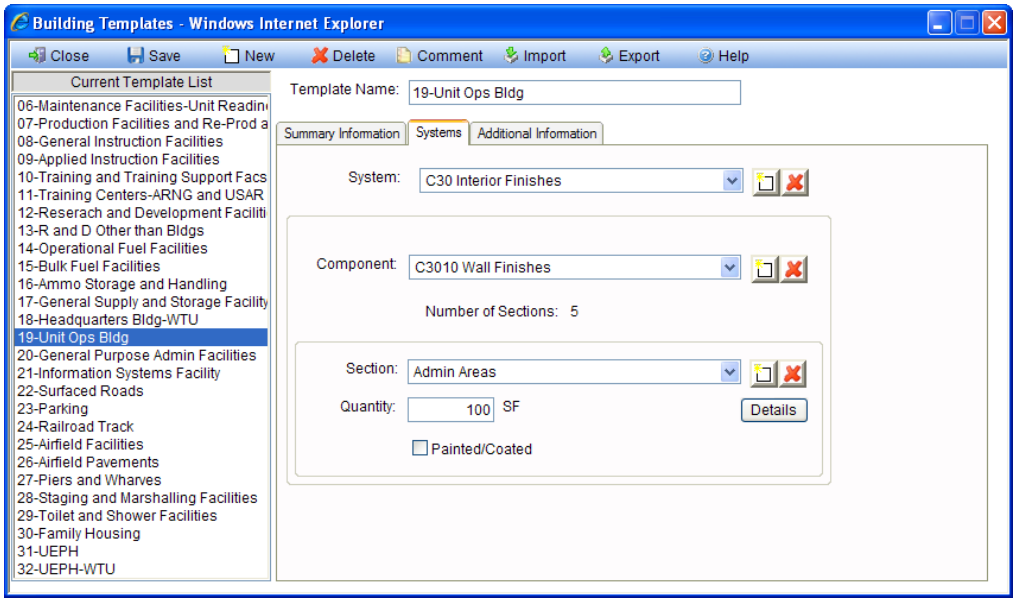


Figure 2. BUILDER templates screen.

The templates provide a streamlined approach for quickly implementing and populating the BUILDER database using existing Army data sources. First, a list of buildings and pertinent attributes such as name, number, CATCODE, year built, and size are imported into the BUILDER Army database. This information comes directly from the official Army real property inventory database, HQIIS. Component-section inventory information is then rapidly generated for these buildings using the ISR-I building templates. The appropriate template for each building is applied on the basis of facility CATCODE and booklet number. The result is a general data structure that follows the ISR-I component rating criteria.

If facility managers using BUILDER want to add additional information or more details about facility component inventory, this can be performed after the initial database has been populated. Such information may include specific equipment items such as chillers, boilers, water heaters, generators, etc. It may also provide more detail that the ISR-I models do not support, such as material type, quantity, or localized construction information. This additional information provides a more accurate picture of the actual conditions of their individual facilities for planning purposes.

The benefit of the approach described above is the minimal time required to initially populate the BUILDER database with useful inventory information that is easily interfaced with ISR-I quality criteria. The next chapter explains how ISR-I facility rating information can be collected electronically to feed BUILDER component condition ratings while simultaneously accomplishing basic ISR-I inspection requirements.

3 Data Collection and System Implementation Guidance

3.1 Paper-based inspection forms

ISR-I data are currently collected using paper inspection sheets. For each building on an installation, a designated person (usually a tenant) will complete the inspection sheet for the individual elements of each building component, as shown in Figure 3.

SAMPLE FACILITY INSPECTION WORKSHEET
UNIT OPERATIONS BUILDINGS (Booklet #19)

SITENO:	Facility Number:	Facility Category Group:	Use with Booklet #
XYZ	XYZ	F00000	00

Site: XYZ_____ FCG Description: _____

UIC: XYZ_____ Unit of Measure: _____

Inspector:_____ Phone#: _____ Date Inspected:_____

Facility Common Components			Mission-Functional Rating Input				Quality Rating Input			
Compo #	Inspection Components	Page No	Green	Amber	Red	N/A	Green	Amber	Red	N/A
1	Site & Grounds	1								
2	Parking	4								
3	Building Exterior - General	8								
4	Building Exterior - Roof	11	N/A	N/A	N/A	N/A				
5	Building Exterior - Walls	12	N/A	N/A	N/A	N/A				
6	Building Exterior - Windows	14	N/A	N/A	N/A	N/A				
7	Building Exterior - Doors	15	N/A	N/A	N/A	N/A				
8	Foundation	16	N/A	N/A	N/A	N/A				
9	Loading Dock/ Service Area	17								
10	Lobby	21								
11	Corridors	25								
12	Stairs	29								
13	Elevator(s)	33								
14	Escalators	35								
15	Administrative Areas	37								
16	Toilets/ Showers/ Locker Rooms	41								
17	Heating/ Ventilation/ Air Conditioning (HVAC)	45	N/A	N/A	N/A	N/A				
18	Electrical Service - Exterior	47								
19	Security Systems	49								
20	Fire Protection	51								

Facility Specific Components			Mission-Functional Rating Input				Quality Rating Input			
Compo #	Inspection Components	Page No	Green	Amber	Red	N/A	Green	Amber	Red	N/A
21	Arms Room	54								
22	Classrooms	59								
23	Conference Room	63								
24	Supply Storage	67								
25	Forensic Laboratories	69								

Figure 3. Sample ISR-I inspection worksheet.

All element ratings are then aggregated to determine the overall rating (Red, Amber, Green) for each component in the building, and also the rat-

ing of the building as a whole. The completed inspection sheet is returned to a central point of contact in the installation's Directorate of Public Works (DPW) office, who manually inputs the information into the Army ISR-I website for storage in a central database.

While the paper-based inspection sheets are easy to use, they have several inherent drawbacks:

- Handwritten data from the hard copies must be keyed manually into the ISR-I website, thus requiring redundant data entry.
- The website records only the aggregated component-level ratings, so the process in effect "filters" hand-recorded data for the individual elements of the components out of the electronic data.
- The process generates a large amount of paper—not only the forms, but also for the 63 ISR-I rating criteria booklets that describe how to apply the ratings for each facility type.

To address these problems, a Microsoft Excel-based utility was developed for electronically collecting ISR-I information during an inspection. Because the information is stored as a digital file, it can be readily copied to the ISR-I website without the need for manual transcription. More importantly for this integration project, the utility allows for ISR-I element-level information to be collected, which is then automatically uploaded to BUILDER. As discussed in Chapter 2, the inventory information for the 63 BUILDER ISR-I templates is created at the element level, which enables BUILDER to capture more detail from the ISR-I assessment. This enhanced data collection technology greatly improves BUILDER's life-cycle analysis and work item identification capabilities.

3.2 Excel-based data collection

The Excel-based ISR-I Data Collection Utility is designed to mimic the paper ISR-I inspection forms. When the inspector first opens utility, the screen shown in Figure 4 appears.

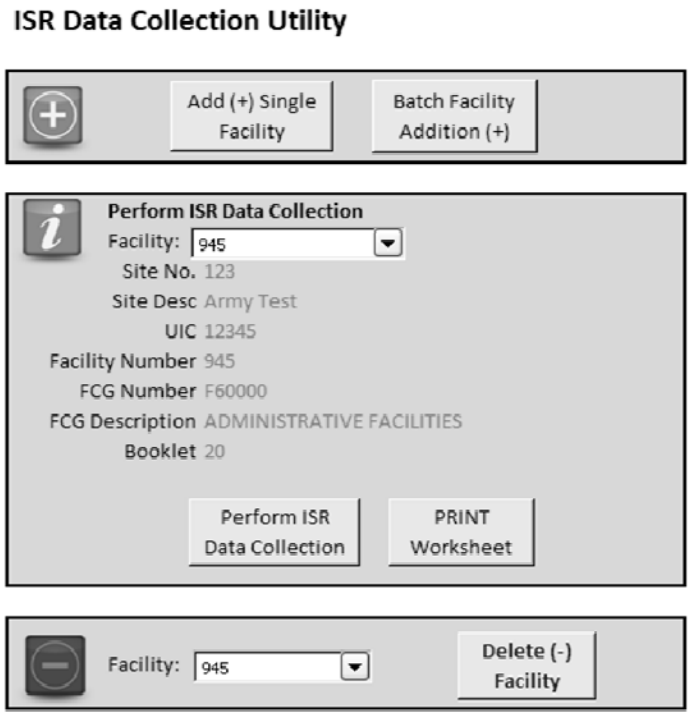


Figure 4. ISR-I Data Collection Utility main screen.

This screen is for adding an individual building or a batch of buildings to the list. The latter case may apply if an inspector is responsible for multiple facilities and the list of buildings can be pre-populated before going out in the field to inspect. When a user chooses to add a building, a screen appears that contains Real Property information for the building, as shown in Figure 5

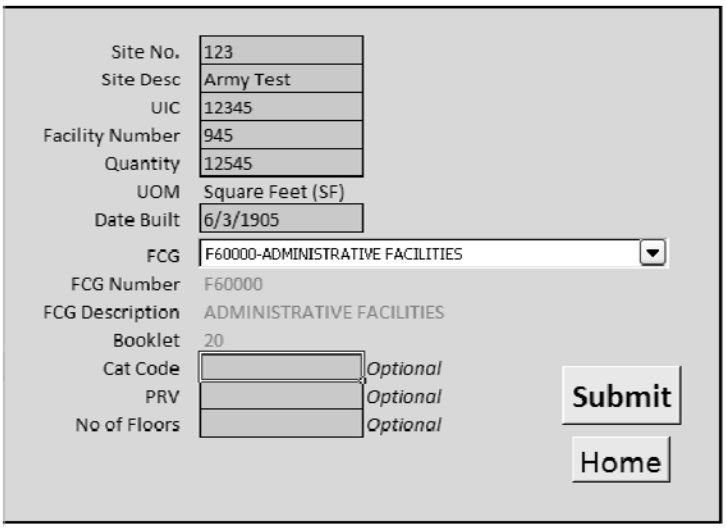
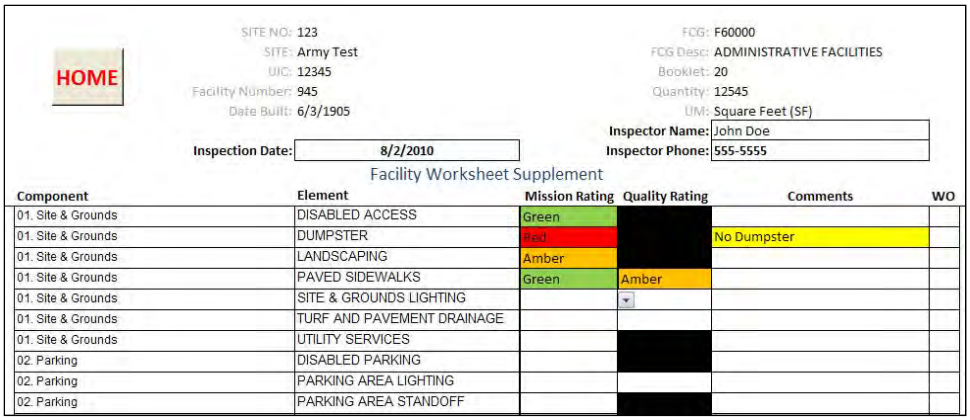


Figure 5. Add (+) Single Facility screen.

After adding the buildings, the inspector can choose to inspect a single building. Selecting the building number and clicking the Submit button brings up the Facility Worksheet Supplement page, where rating information is entered. The worksheet layout is designed to closely follow the paper form (Figure 6).



HOME

SITE NO: 123
SITE: Army Test
UIC: 12345
Facility Number: 945
Date Built: 6/3/1905

FCG: F60000
FCG Desc: ADMINISTRATIVE FACILITIES
Booklet: 20
Quantity: 12545
UM: Square Feet (SF)
Inspector Name: John Doe
Inspector Phone: 555-5555

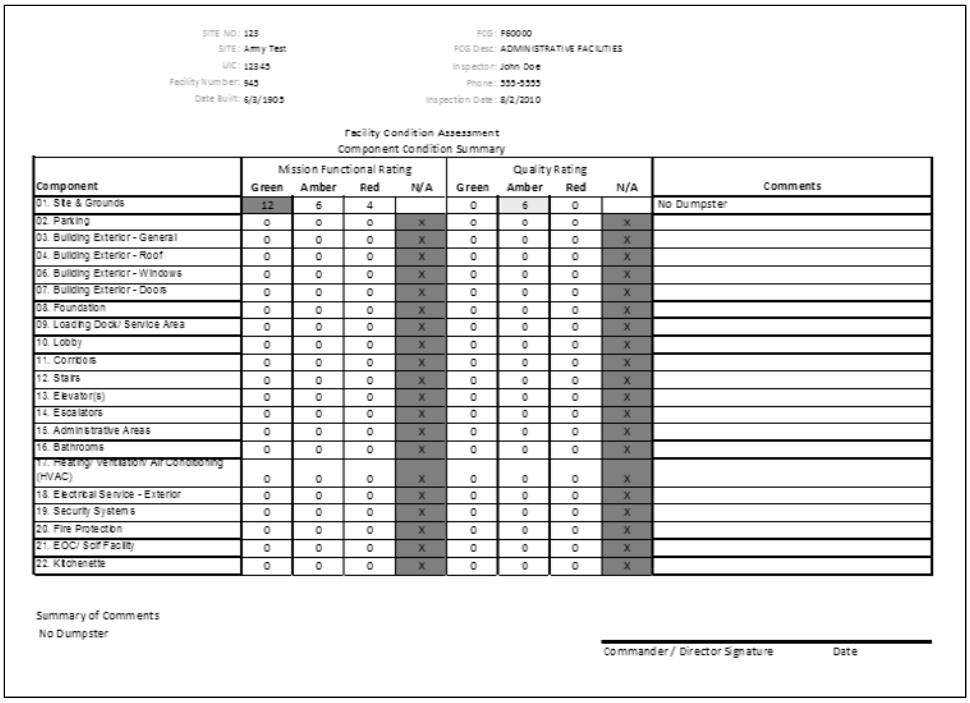
Inspection Date: 8/2/2010

Facility Worksheet Supplement

Component	Element	Mission Rating	Quality Rating	Comments	WO
01. Site & Grounds	DISABLED ACCESS	Green			
01. Site & Grounds	DUMPSTER	Red		No Dumpster	
01. Site & Grounds	LANDSCAPING	Amber			
01. Site & Grounds	PAVED SIDEWALKS	Green	Amber		
01. Site & Grounds	SITE & GROUNDS LIGHTING				
01. Site & Grounds	TURF AND PAVEMENT DRAINAGE				
01. Site & Grounds	UTILITY SERVICES				
02. Parking	DISABLED PARKING				
02. Parking	PARKING AREA LIGHTING				
02. Parking	PARKING AREA STANDOFF				

Figure 6. Facility Worksheet Supplement page (sample).

After inspecting one or more of the buildings, the Component Summary Worksheet can be viewed or printed. The summary spreadsheet provides the information that is loaded into the ISR-I web application, and it can be printed for archiving purposes.



SITE NO: 123
SITE: Army Test
UIC: 12345
Facility Number: 945
Date Built: 6/3/1905

FCG: F60000
FCG Desc: ADMINISTRATIVE FACILITIES
Inspector: John Doe
Phone: 555-5555
Inspection Date: 8/2/2010

Facility Condition Assessment
Component Condition Summary

Component	Mission Functional Rating				Quality Rating				Comments
	Green	Amber	Red	N/A	Green	Amber	Red	N/A	
01. Site & Grounds	12	6	4		0	6	0		No Dumpster
02. Parking	0	0	0	X	0	0	0	X	
03. Building Exterior - General	0	0	0	X	0	0	0	X	
04. Building Exterior - Roof	0	0	0	X	0	0	0	X	
06. Building Exterior - Windows	0	0	0	X	0	0	0	X	
07. Building Exterior - Doors	0	0	0	X	0	0	0	X	
08. Foundation	0	0	0	X	0	0	0	X	
09. Loading Dock/ Service Area	0	0	0	X	0	0	0	X	
10. Lobby	0	0	0	X	0	0	0	X	
11. Corridors	0	0	0	X	0	0	0	X	
12. Stairs	0	0	0	X	0	0	0	X	
13. Elevator(s)	0	0	0	X	0	0	0	X	
14. Escalators	0	0	0	X	0	0	0	X	
15. Administrative Areas	0	0	0	X	0	0	0	X	
16. Bathrooms	0	0	0	X	0	0	0	X	
17. Heating/ Ventilation/ Air Conditioning (HVAC)	0	0	0	X	0	0	0	X	
18. Electrical Service - Exterior	0	0	0	X	0	0	0	X	
19. Security Systems	0	0	0	X	0	0	0	X	
20. Fire Protection	0	0	0	X	0	0	0	X	
21. EOC/ SolF Facility	0	0	0	X	0	0	0	X	
22. Kitchenette	0	0	0	X	0	0	0	X	

Summary of Comments
No Dumpster

Commander / Director Signature Date

Figure 7. Component Condition Summary worksheet page (sample).

3.3 Enterprise information technology considerations

With use of the Excel-based ISR-I data collection utility, facility assessment information is easily loaded into BUILDER and the centralized ISR-I website. This procedure provides work-planning and life-cycle facility analysis metrics for SRM planning. BUILDER has an open data architecture to permit information exchange with other electronic Army management systems and data repositories. These communication links are created using web services and data exchange features based on Extensible Markup Language (XML). Integration with other Army systems is required to effectively employ BUILDER for a seamless management and reporting process. A conceptual schematic of integration with other corporate Army facility management systems is shown in Figure 8.

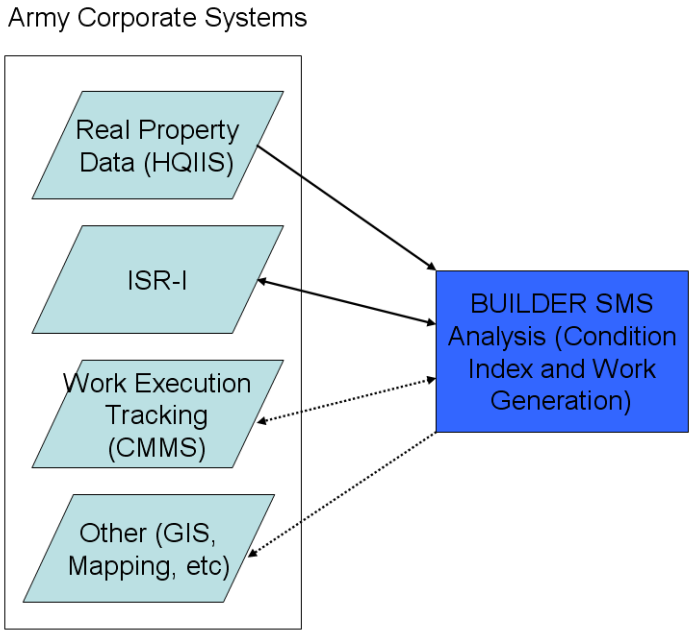


Figure 8. Conceptual integration schematic of BUILDER with Army enterprise-level systems.

4 Summary and Recommendations

4.1 Summary

The research team identified considerable synergies between BUILDER and the ISR-I that may be exploited for improved management of Army facilities. By mapping standard data elements that are common to both systems, a framework for data exchange was created. This framework is used to initially populate the BUILDER database with ISR-I information, which substantially lowers the cost of SMS implementation at an installation. While in some instances ISR-I information is not as detailed as the BUILDER component-level inventory data, the effort involved to initially populate the BUILDER database is negligible. More accurate information is entered into BUILDER later, as needed and available, to refine or update facility inventory data (component and material types and quantities), condition assessments, or a project scope. Using this approach, installations can realize the benefits of BUILDER without incurring significant costs above those related to the ISR-I inspection effort.

In order to link BUILDER to the ISR-I component data structure, a catalog of building templates was created in BUILDER for each of the 63 ISR-I rating standards booklets. Once a set of buildings from the Army real property inventory is captured in the BUILDER database, the templates can be used to rapidly create system and component inventories for those buildings. This methodology allows facility life-cycle information to be stored along with the general condition data traditionally provided in the ISR-I.

Also, specific mission-required components identified in the Army Facility Standards and Standard Designs are included in the templates. Furthermore, these standardized templates may be applied to additional buildings types, with more detail, based on the Army's facility category groupings (FCGs). These features, along with more detailed component quantities, material types, and equipment types, support future refinement of the template models to a very fine level of detail.

4.2 Recommendations

This project demonstrated the capability to import information from the ISR-I database to populate the BUILDER database. However, BUILDER's detailed, objective assessment techniques and work requirements identification produce information that could beneficially be fed into the ISR-I using data mapping solution described in this report. The capability to automatically upload BUILDER data into ISR-I has not been developed. It is recommended that an automated import process be developed for ISR-I to make this data exchange possible to further streamline the facility management process. To accommodate this development, BUILDER technology should be further integrated within the Army's Facility Management Enterprise Framework, with attention to the information technology (IT) considerations discussed below.

4.2.1 Hosting configuration

BUILDER is a fully web-based enterprise software platform that currently supports SQL Server 7.0, 2000, and 2005 (including Express Edition). Support for Oracle is planned for implementation in the near future. All user interface elements run in web browser applications using standard Hypertext Markup Language (HTML) and Javascript. The pilot implementation of the BUILDER database is currently hosted on servers located and supported at ERDC-CERL in Champaign, IL.

Upon wide-scale adoption throughout the Army, it is recommended that BUILDER be transitioned to a centralized data server/support center as appropriate. This configuration would allow for fast, secure multiuser access to information and support automated backups of the Army BUILDER database.

4.2.2 Technical assistance and helpdesk support

To support to BUILDER users who need access to facility functionality information, technical assistance would be required by email or telephone. It is recommended that such support be provided by the Army's Computer Hardware, Enterprise Software and Solutions (CHESS) contract for services. Technical assistance should address detailed software and how-to questions, diagnose problems, and document program errors or bugs to be communicated to the software developer.

Periodic onsite support may be required to configure server and database setup of the BUILDER program and coordinate IT integration with other Army facility management systems, including HQIIS, Army Mapper, ISR-I, and the General Fund Enterprise Business System (GFEBS). In addition, an annual user group meeting is recommended to allow program enhancements and new features to be identified and prioritized with input from the user community.

Abbreviations

ACSIM – Assistant Chief of Staff for Installation Management

ASTM – American Society of Testing and Materials

CERL – Construction Engineering Research Laboratory

CHESS – Computer Hardware, Enterprise Software and Solutions

CI – Condition Index

CMMS – Computerized Maintenance Management System

DPW – Directorate of Public Works

ERDC – Engineer Research and Development Center

FCG – Facility Category Group

FI – Functionality Index

GFEBS – General Fund Enterprise Business System

GIS – Geographic Information System

HVAC – Heating, Ventilation, and Air Conditioning

HQ - Headquarters

HQIIS – Headquarters Installation Information System

ISR-I – Installation Status Report for Infrastructure

IT – Information Technology

ITTP – Installation Technology Transition Program

LAN – Local Area Network

SMS – Sustainment Management System

SRM – Sustainment, Restoration, Modernization

XML – Extensible Markup Language

References

ASTM-E 1557-02. Standard Classification for Building Elements – Uniformat II.

BUILDER Engineered Management System Fact-Sheet. Champaign IL: ERDC-CERL. https://www.cecer.army.mil.

Grussing, M.N., and L.R. Marrano. July 2007. "Building Component Lifecycle Repair/Replacement Model for Institutional Facility Management." ASCE Conf Proc., *Computing in Civil Engineering*.

Grussing, M.N. et al. August 2006. "Optimizing Facility Component Maintenance, Repair, and Restoration Investment Strategies Using Financial ROI Metrics and Consequence Analysis." ASCE Conf Proc., *Applications of Advanced Technology in Transportation*.

Grussing, M.N. et al. August 2006. "Condition and Reliability Prediction Models using the Weibull Probability Distribution." ASCE Conf Proc., *Applications of Advanced Technology in Transportation*.

Installation Status Report – Infrastructure (2010). Standards Rating Booklet 6, "Maintenance Facilities – Unit Readiness."

Installation Status Report – Infrastructure (2010). Standards Rating Booklet 19, "Unit Operations Buildings."

Knowledge-Based Condition Assessment Manual for Building Component-Sections. Champaign IL: ERDC-CERL.

US Patent 7,058,544, "Knowledge-Based Condition Survey Inspection."

Uzarski, D.R. et al. March 2007. "Knowledge-Based Condition Survey Inspection Concepts." *ASCE Journal of Infrastructure Systems*.

Uzarski, D.R. and M.N. Grussing. "Building Condition Assessment Metrics: Best Practices." *ASCE Special Report on Infrastructure Condition Reporting*.

Appendix A: Index of ISR-I Rating Standards Booklets

Number	Facility Type
01	LIVE FIRE RANGES
02	LIVE FIRE RANGES - INDOOR
03	IMPACT AREA DUDDED
04	NON-LIVE FIRE TRAINING FACILITIES
05	MANEUVER/TRAINING LAND
06	MAINTENANCE FACILITIES - UNIT READINESS
07	PRODUCTION FACILITIES & RE-PRODUCTION AT DEPOTS
08	GENERAL INSTRUCTION FACILITIES
09	APPLIED INSTRUCTION FACILITIES
10	TRAINING/TRAINING SUPPORT FACILITIES
11	TRAINING CENTERS – ARNG AND USAR
12	RESEARCH & DEVELOPMENT FACILITIES
13	RESEARCH & DEVELOPMENT FACILITIES OTHER THAN BUILDINGS
14	OPERATIONAL FUEL FACILITIES
15	BULK FUEL FACILITIES
16	AMMUNITION STORAGE FACILITIES & HANDLING
17	GENERAL SUPPLY & STORAGE FACILITIES
18	HEADQUARTER BUILDINGS - WARRIOR TRANSITION UNIT (WTU)
19	UNIT OPERATIONS BUILDINGS
20	GENERAL PURPOSE ADMINISTRATIVE FACILITIES
21	INFORMATION SYSTEMS FACILITIES
22	SURFACED ROADS
23	PARKING
24	RAILROAD TRACK
25	AIRFIELD FACILITIES
26	AIRFIELD PAVEMENTS
27	PIERS & WHARVES
28	STAGING & MARSHALING FACILITIES
29	SEPARATE TOILET & SHOWER FACILITIES
30	FAMILY HOUSING
31	UNACCOMPANIED ENLISTED PERSONNEL HOUSING (UEPH)

Number	Facility Type
32	ENLISTED UNACCOMPANIED PERSONNEL HOUSING - WARRIOR TRANSITION UNIT (WTU)
33	SENIOR BACHELOR ENLISTED & BACHELOR OFFICER QUARTERS
34	RC/AT TRAINING BARRACKS
35	ARMY LODGING
36	TRANSIENT UPH AST
37	IET TRAINING BARRACKS AIT
38	IET TRAINING BARRACKS BT
39	DINING FACILITIES
40	POST EXCHANGE
41	COMMISSARY
42	MEDICAL CENTERS/HOSPITALS
43	MEDICAL SUPPORT FACILITIES
44	VETERINARY FACILITIES
45	DENTAL FACILITIES
46	DISPENSARIES AND CLINICS
47	CHILD DEVELOPMENT CENTERS
48	DEPENDENT SCHOOL FACILITIES
49	CONTINUING EDUCATION FACILITIES
50	PHYSICAL FITNESS FACILITIES
51	OUTDOOR SPORTS & RECREATION FACILITIES
52	RECREATION FACILITIES
53	SERVICE FACILITIES
54	HEAT/AIR CONDITIONING SOURCE
55	HEAT/AIR CONDITIONING DISTRIBUTION
56	ELECTRIC SOURCE
57	ELECTRIC DISTRIBUTION
58	ELECTRIC SUBSTATIONS
59	GAS DISTRIBUTION
60	WATER SOURCE/TREATMENT
61	WATER STORAGE
62	WATER DISTRIBUTION
63	WASTEWATER TREATMENT & DISPOSAL
64	WASTEWATER COLLECTION
65	EMERGENCY TROOP HOUSING (HUTMENTS)

Appendix B: ISR-I Criteria from Booklet 19

Comp* Number	Comp Description	Comp Type	Element Category	Priority
19.01	Site & Grounds	Common Components	DISABLED ACCESS	H
19.01	Site & Grounds	Common Components	DUMPSTER	L
19.01	Site & Grounds	Common Components	LANDSCAPING	M
19.01	Site & Grounds	Common Components	PAVED SIDEWALKS	M
19.01	Site & Grounds	Common Components	SITE & GROUNDS LIGHTING	H
19.01	Site & Grounds	Common Components	TURF AND PAVEMENT DRAINAGE	H
19.01	Site & Grounds	Common Components	UTILITY SERVICES	L
19.02	Parking	Common Components	DISABLED PARKING	H
19.02	Parking	Common Components	PARKING AREA LIGHTING	H
19.02	Parking	Common Components	PARKING AREA STANDOFF	H
19.02	Parking	Common Components	PARKING AVAILABILITY	H
19.02	Parking	Common Components	PARKING LANDSCAPING	L
19.02	Parking	Common Components	PARKING PAVEMENT DRAINAGE	H
19.02	Parking	Common Components	PARKING SIGNAGE	L
19.02	Parking	Common Components	PARKING SPACES	M
19.02	Parking	Common Components	PAVEMENT CONDITION	H
19.03	Building Exterior - General	Common Components	BUILDING EXTERIOR SIGNAGE	M
19.03	Building Exterior - General	Common Components	DISABLED ACCESS	H
19.03	Building Exterior - General	Common Components	EXTERIOR LIGHTING	H
19.03	Building Exterior - General	Common Components	MECHANICAL EQUIPMENT	L
19.03	Building Exterior - General	Common Components	OUTSIDE DRAINAGE	H
19.04	Building Exterior - Roof	Common Components	ROOF	H
19.06	Building Exterior - Windows	Common Components	WINDOWS	H
19.07	Building Exterior - Doors	Common Components	EXTERIOR DOORS	H
19.08	Foundation	Common Components	FOUNDATION	M
19.09	Loading Dock/ Service Area	Common Components	DOCK BOARDS & STATION LIFTS	H
19.09	Loading Dock/ Service Area	Common Components	DOCK WALLS	L

* Component.

Comp* Number	Comp Description	Comp Type	Element Category	Priority
19.09	Loading Dock/ Service Area	Common Components	LIGHTING & OUTLETS	H
19.09	Loading Dock/ Service Area	Common Components	LOADING DOCK FLOOR	M
19.09	Loading Dock/ Service Area	Common Components	SERVICE DOORS	M
19.09	Loading Dock/ Service Area	Common Components	SIGNAGE	L
19.09	Loading Dock/ Service Area	Common Components	TRUCK AREA	H
19.1	Lobby	Common Components	CEILINGS	M
19.1	Lobby	Common Components	COMPUTER/LAN SYSTEM	M
19.1	Lobby	Common Components	FLOORS	M
19.1	Lobby	Common Components	INTERIOR DOORS	M
19.1	Lobby	Common Components	LIGHTING & OUTLETS	H
19.1	Lobby	Common Components	LOBBY AREA	H
19.1	Lobby	Common Components	SIGNAGE	L
19.1	Lobby	Common Components	TELEPHONE SYSTEM	M
19.1	Lobby	Common Components	WALLS	M
19.1	Lobby	Common Components	WINDOWS	M
19.11	Corridors	Common Components	CEILINGS	M
19.11	Corridors	Common Components	CORRIDOR DOORS	M
19.11	Corridors	Common Components	CORRIDOR SIGNAGE	L
19.11	Corridors	Common Components	CORRIDOR TRANSIT AREA	H
19.11	Corridors	Common Components	FLOORS	M
19.11	Corridors	Common Components	LIGHTING & OUTLETS	H
19.11	Corridors	Common Components	WALLS	M
19.11	Corridors	Common Components	WINDOWS	M
19.12	Stairs	Common Components	CEILINGS	M
19.12	Stairs	Common Components	LANDINGS & TREADS	H
19.12	Stairs	Common Components	LIGHTING & OUTLETS	H
19.12	Stairs	Common Components	SIGNAGE	L
19.12	Stairs	Common Components	STAIR DOORS	H
19.12	Stairs	Common Components	WALLS	M
19.12	Stairs	Common Components	WINDOWS	M
19.13	Elevator(s)	Common Components	CAPACITY	H
19.13	Elevator(s)	Common Components	ELEVATOR CAB(S)	M
19.13	Elevator(s)	Common Components	ELEVATOR SIGNAGE	L
19.13	Elevator(s)	Common Components	FUNCTIONALITY	H
19.13	Elevator(s)	Common Components	SAFETY STANDARDS	H

Comp* Number	Comp Description	Comp Type	Element Category	Priority
19.14	Escalators	Common Components	FUNCTIONALITY	H
19.14	Escalators	Common Components	HANDHOLDS	M
19.14	Escalators	Common Components	SAFETY STANDARDS	H
19.14	Escalators	Common Components	SIGNAGE	L
19.15	Administrative Areas	Common Components	CEILINGS	M
19.15	Administrative Areas	Common Components	COMPUTER/LAN SYSTEM	M
19.15	Administrative Areas	Common Components	FLOORS	M
19.15	Administrative Areas	Common Components	INTERIOR DOORS	M
19.15	Administrative Areas	Common Components	LIGHTING & OUTLETS	H
19.15	Administrative Areas	Common Components	SIGNAGE	L
19.15	Administrative Areas	Common Components	TELEPHONE SYSTEM	M
19.15	Administrative Areas	Common Components	WALLS	M
19.15	Administrative Areas	Common Components	WINDOWS	M
19.15	Administrative Areas	Common Components	WORK AREA	H
19.16	Toilets/ Showers/ Locker Rooms	Common Components	BATHROOM ACCESSORIES	L
19.16	Toilets/ Showers/ Locker Rooms	Common Components	CEILINGS	M
19.16	Toilets/ Showers/ Locker Rooms	Common Components	DISABLED ACCESS	H
19.16	Toilets/ Showers/ Locker Rooms	Common Components	DOORS	M
19.16	Toilets/ Showers/ Locker Rooms	Common Components	FLOORS	M
19.16	Toilets/ Showers/ Locker Rooms	Common Components	LIGHTING & OUTLETS	H
19.16	Toilets/ Showers/ Locker Rooms	Common Components	LOCKER/SHOWERS	M
19.16	Toilets/ Showers/ Locker Rooms	Common Components	PLUMBING FIXTURES	H
19.16	Toilets/ Showers/ Locker Rooms	Common Components	TOILETS/SINKS AVAILABILITY	H
19.16	Toilets/ Showers/ Locker Rooms	Common Components	VENTILATION	H
19.16	Toilets/ Showers/ Locker Rooms	Common Components	WALLS	M
19.16	Toilets/ Showers/ Locker Rooms	Common Components	WINDOWS	M
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	COOLING	H

Comp* Number	Comp Description	Comp Type	Element Category	Priority
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	HEATING	H
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	HVAC CONTROLS	H
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	HVAC DISTRIBUTION SYSTEM	M
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	RADIATORS	L
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	THROUGH-THE-WALL-HVAC UNITS	M
19.17	Heating/ Ventilation/ Air Conditioning (HVAC)	Common Components	WINDOW AC UNITS	M
19.18	Electrical Service - Exterior	Common Components	ELECTRICAL SERVICE	H
19.18	Electrical Service - Exterior	Common Components	EMERGENCY POWER	H
19.18	Electrical Service - Exterior	Common Components	UNINTERRUPTED POWER SUPPLY	H
19.19	Security Systems	Common Components	CONTROLLED ENTRY	H
19.19	Security Systems	Common Components	SECURITY SYSTEMS	H
19.2	Fire Protection	Common Components	FIRE ALARM SYSTEMS	H
19.2	Fire Protection	Common Components	FIRE EXTINGUISHERS	M
19.2	Fire Protection	Common Components	SMOKE/HEAT SENSING DETECTORS	M
19.2	Fire Protection	Common Components	SPRINKLERS	H
19.2	Fire Protection	Common Components	STANDPIPE SYSTEM	M
19.21	Arms Room	Facility Specific Components	ARMS ROOM SECURITY	H
19.21	Arms Room	Facility Specific Components	ARMS ROOM WORK AREA	M
19.21	Arms Room	Facility Specific Components	CEILINGS	M
19.21	Arms Room	Facility Specific Components	COMPUTER/LAN SYSTEM	M
19.21	Arms Room	Facility Specific Components	DOORS	M
19.21	Arms Room	Facility Specific Components	FLOORS	M
19.21	Arms Room	Facility Specific Components	LIGHTING & OUTLETS	H
19.21	Arms Room	Facility Specific Components	SIGNAGE	L
19.21	Arms Room	Facility Specific	TELEPHONE SYSTEM	M

Comp* Number	Comp Description	Comp Type	Element Category	Priority
		Components		
19.21	Arms Room	Facility Specific Components	VENTILATION	H
19.21	Arms Room	Facility Specific Components	WALLS	M
19.21	Arms Room	Facility Specific Components	WEAPONS STORAGE	M
19.21	Arms Room	Facility Specific Components	WINDOWS AND OTHER OPENINGS	M
19.22	Classrooms	Facility Specific Components	AUDIO VISUAL (A/V)	H
19.22	Classrooms	Facility Specific Components	CEILINGS	M
19.22	Classrooms	Facility Specific Components	COMPUTER/LAN SYSTEM	M
19.22	Classrooms	Facility Specific Components	DOORS	M
19.22	Classrooms	Facility Specific Components	FLOORS	M
19.22	Classrooms	Facility Specific Components	LIGHTING & OUTLETS	H
19.22	Classrooms	Facility Specific Components	SPACE LAYOUT	H
19.22	Classrooms	Facility Specific Components	WALLS	M
19.22	Classrooms	Facility Specific Components	WINDOWS	M
19.23	Conference Room	Facility Specific Components	AUDIO VISUAL (A/V)	H
19.23	Conference Room	Facility Specific Components	CEILINGS	M
19.23	Conference Room	Facility Specific Components	COMPUTER/LAN SYSTEM	M
19.23	Conference Room	Facility Specific Components	DOORS	M
19.23	Conference Room	Facility Specific Components	FLOORS	M
19.23	Conference Room	Facility Specific Components	SECURITY	H
19.23	Conference Room	Facility Specific Components	SPACE LAYOUT	H
19.23	Conference Room	Facility Specific Components	TELEPHONE SYSTEM	H

Comp* Number	Comp Description	Comp Type	Element Category	Priority
19.23	Conference Room	Facility Specific Components	VARIABLE LIGHTING	H
19.23	Conference Room	Facility Specific Components	WALLS	M
19.23	Conference Room	Facility Specific Components	WINDOWS	M
19.24	Supply Storage	Facility Specific Components	CEILINGS	M
19.24	Supply Storage	Facility Specific Components	DOORS	M
19.24	Supply Storage	Facility Specific Components	FLOORS	M
19.24	Supply Storage	Facility Specific Components	SPACE LAYOUT	H
19.24	Supply Storage	Facility Specific Components	WALLS	M
19.25	Forensic Laboratories	Facility Specific Components	CEILINGS	M
19.25	Forensic Laboratories	Facility Specific Components	COMPUTER/LAN SYSTEM	M
19.25	Forensic Laboratories	Facility Specific Components	FLOORS	M
19.25	Forensic Laboratories	Facility Specific Components	FUME HOODS	H
19.25	Forensic Laboratories	Facility Specific Components	JOINT COMMISSION ACCREDITATION HEALTHCARE ORGANIZATIONS (JACHO) AND/OR COLLEGE OF AMERICAN PATHOLOGISTS (CAP) CONTINGENCIES	H
19.25	Forensic Laboratories	Facility Specific Components	LAB DOORS	M
19.25	Forensic Laboratories	Facility Specific Components	LAB REFRIGERATION	H
19.25	Forensic Laboratories	Facility Specific Components	LAB VENTILATION	H
19.25	Forensic Laboratories	Facility Specific Components	LABORATORY WORK AREA	H
19.25	Forensic Laboratories	Facility Specific Components	LIGHTING & OUTLETS	H
19.25	Forensic Laboratories	Facility Specific Components	MEDICAL GASES	H
19.25	Forensic Laboratories	Facility Specific Components	SIGNAGE	L

Comp* Number	Comp Description	Comp Type	Element Category	Priority
19.25	Forensic Laboratories	Facility Specific Components	TELEPHONE SYSTEM	M
19.25	Forensic Laboratories	Facility Specific Components	WALLS	M
19.25	Forensic Laboratories	Facility Specific Components	WINDOWS	M

Appendix C: BUILDER Example Inventory Data Template for Booklet 19

System	Component	Section Name	Mat/Equip	Comp Type	Qty	UM
A10 Foundations	A1010 Standard Foundations	Foundation	N/A	N/A	1000	SF
B10 Superstructure	B1010 Floor Construction	Loading Dock/Service Area	Loading Dock	N/A	50	SF
B20 Exterior Closure	B2010 Exterior Walls	Loading Dock/Service Area	Dock Walls	N/A	50	SF
B20 Exterior Closure	B2020 Exterior Windows	Building Exterior	N/A	N/A	10	EA
B20 Exterior Closure	B2030 Exterior Doors	Building Exterior	Personnel	N/A	2	EA
B20 Exterior Closure	B2030 Exterior Doors	Loading Dock/Service Area	Service	N/A	1	EA
B30 Roofing	B3010 Roof Coverings	Building Exterior	Roof Drainage	N/A	200	LF
B30 Roofing	B3010 Roof Coverings	Roofing System	Roof	N/A	1000	SF
C10 Interior Construction	C1010 Partitions	Admin Area	Window	N/A	1	EA
C10 Interior Construction	C1010 Partitions	Corridors	Window	N/A	1	EA
C10 Interior Construction	C1010 Partitions	Lobby	Window	N/A	1	EA
C10 Interior Construction	C1010 Partitions	Restrooms/Showers/Lockers	Window	N/A	1	EA
C10 Interior Construction	C1010 Partitions	Stairwells	Window	N/A	1	EA
C10 Interior Construction	C1020 Interior Doors	Admin Areas	Personnel	N/A	1	EA
C10 Interior Construction	C1020 Interior Doors	Corridors	Personnel	N/A	1	EA
C10 Interior Construction	C1020 Interior Doors	Lobby	Personnel	N/A	1	EA
C10 Interior Construction	C1020 Interior Doors	Restrooms/Showers/Lockers	Personnel	N/A	1	EA
C10 Interior Construction	C1020 Interior Doors	Stairwells	Personnel	N/A	1	EA

System	Component	Section Name	Mat/Equip	Comp Type	Qty	UM
C10 Interior Construction	C1030 Fittings	Admin Areas	Interior Signage	N/A	1	EA
C10 Interior Construction	C1030 Fittings	Corridors	Interior Signage	N/A	1	EA
C10 Interior Construction	C1030 Fittings	Loading Dock/ Service Area	Interior Signage	N/A	1	EA
C10 Interior Construction	C1030 Fittings	Lobby	Interior Signage	N/A	1	EA
C10 Interior Construction	C1030 Fittings	Restrooms/Showers/Lockers	Bathroom Accessories	N/A	1	EA
C10 Interior Construction	C1030 Fittings	Restrooms/Showers/Lockers	Lockers	N/A	1	EA
C10 Interior Construction	C1030 Fittings	Stairwells	Interior Signage	N/A	1	EA
C20 Staircases	C2010 Stair Construction	Stairwells	Landings and Treads	N/A	50	SF
C30 Interior Finishes	C3010 Wall Finishes	Admin Areas	N/A	N/A	100	SF
C30 Interior Finishes	C3010 Wall Finishes	Corridors	N/A	N/A	100	SF
C30 Interior Finishes	C3010 Wall Finishes	Lobby	N/A	N/A	100	SF
C30 Interior Finishes	C3010 Wall Finishes	Restrooms/Showers/Lockers	N/A	N/A	100	SF
C30 Interior Finishes	C3010 Wall Finishes	Stairwells	N/A	N/A	100	SF
C30 Interior Finishes	C3020 Floor Finishes	Admin Areas	N/A	N/A	10	SF
C30 Interior Finishes	C3020 Floor Finishes	Corridors	N/A	N/A	10	SF
C30 Interior Finishes	C3030 Ceiling Finishes	Lobby	N/A	N/A	10	SF
C30 Interior Finishes	C3030 Ceiling Finishes	Restrooms/Showers/Lockers	N/A	N/A	10	SF
C30 Interior Finishes	D1010 Elevators & Lifts	Elevators	N/A	N/A	1	EA
C30 Interior Finishes	D1010 Elevators & Lifts	Elevators	N/A	N/A	1	EA
C30 Interior Finishes	D1010 Elevators & Lifts	Elevators	N/A	N/A	1	EA
C30 Interior Finishes	D1010 Elevators & Lifts	Elevators	N/A	N/A	1	EA
C30 Interior	D1010 Elevators	Elevators	N/A	N/A	1	EA

System	Component	Section Name	Mat/Equip	Comp Type	Qty	UM
Finishes	& Lifts					
D10 Conveying Systems	D1020 Escalators & Moving Walks	Escalators	N/A	N/A	1	EA
D10 Conveying Systems	D1020 Escalators & Moving Walks	Escalators	N/A	N/A	1	EA
D20 Plumbing	D2010 Plumbing Fixtures	Restrooms/Showers/Lockers	Lavatory Sink	Ceramic	1	EA
D20 Plumbing	D2010 Plumbing Fixtures	Restrooms/Showers/Lockers	N/A	N/A	1	EA
D20 Plumbing	D2010 Plumbing Fixtures	Restrooms/Showers/Lockers	Shower	Single Head	1	EA
D20 Plumbing	D2010 Plumbing Fixtures	Restrooms/Showers/Lockers	Toilet	Ceramic	1	EA
D30 HVAC	D3020 Heat Generating Systems	HVAC System	N/A	N/A	1	EA
D30 HVAC	D3030 Cooling Generating Systems	HVAC System	N/A	N/A	1	EA
D30 HVAC	D3040 Distribution Systems	HVAC System	N/A	N/A	1	EA
D30 HVAC	D3040 Distribution Systems	Restrooms/Showers/Lockers	Ventilation System	N/A	1	EA
D30 HVAC	D3050 Terminal & Package Units	HVAC System	Radiators	N/A	1	EA
D30 HVAC	D3050 Terminal & Package Units	HVAC System	Thru-Wall HVAC Equipment	N/A	1	EA
D30 HVAC	D3050 Terminal & Package Units	HVAC System	Window AC Units	N/A	1	EA
D30 HVAC	D3060 Controls & Instrumentation	HVAC System	N/A	N/A	1	EA
D40 Fire Protection	D4010 Sprinklers	Fire Protection System	N/A	N/A	1000	SF
D40 Fire Protection	D4020 Standpipes	Fire Protection System	N/A	N/A	10	LF

System	Component	Section Name	Mat/Equip	Comp Type	Qty	UM
D40 Fire Protection	D4030 Fire Protection Specialties	Fire Protection System	Fire Extinguisher	N/A	1	EA
D40 Fire Protection	D4030 Fire Protection Specialties	Fire Protection System	Smoke/Heat Detectors	N/A	1	EA
D50 Electrical	D5010 Electrical Service & Distribution	Electrical System	N/A	N/A	1000	SF
D50 Electrical	D5020 Lighting & Branch Wiring	Admin Areas	Lighting and Outlets	N/A	10	SF
D50 Electrical	D5020 Lighting & Branch Wiring	Building Exterior	Exterior Lighting	N/A	1	EA
D50 Electrical	D5020 Lighting & Branch Wiring	Corridors	Lighting and Outlets	N/A	10	SF
D50 Electrical	D5020 Lighting & Branch Wiring	Loading Dock/Service Area	Lighting and Outlets	N/A	10	SF
D50 Electrical	D5020 Lighting & Branch Wiring	Lobby	Lighting and Outlets	N/A	10	SF
D50 Electrical	D5020 Lighting & Branch Wiring	Restrooms/Showers/Lockers	Lighting and Outlets	N/A	10	SF
D50 Electrical	D5020 Lighting & Branch Wiring	Stairwells	Lighting and Outlets	N/A	10	SF
D50 Electrical	D5030 Communications & Security	Admin Area	Computer/LAN System	N/A	10	SF
D50 Electrical	D5030 Communications & Security	Admin Areas	Telephone System	N/A	10	SF
D50 Electrical	D5030 Communications & Security	Fire Protection System	Fire Alarm System	N/A	1000	SF
D50 Electrical	D5030 Communications & Security	Lobby	Computer/LAN System	N/A	10	SF
D50 Electrical	D5030 Communications & Security	Lobby	Telephone System	N/A	10	SF
D50 Electrical	D5030 Communications & Security	Security System	Controlled Entry	N/A	1000	SF
D50 Electrical	D5030 Communications & Security	Security System	Security System	N/A	1000	SF
D50 Electrical	D5090 Other	Electrical System	Emergency	N/A	1	EA

System	Component	Section Name	Mat/Equip	Comp Type	Qty	UM
	Electrical Systems		Power			
D50 Electrical	D5090 Other Electrical Systems	Electrical System	UPS	N/A	1	EA
E10 Equipment	E1030 Vehicular Equipment	Loading Dock/Service Area	Dock Equipment	N/A	1	EA
G20 Site Improvements	G2020 Parking Lots	Disabled Parking	N/A	N/A	100	SF
G20 Site Improvements	G2020 Parking Lots	General Parking	N/A	N/A	1000	SF
G20 Site Improvements	G2030 Pedestrian Paving	Site & Grounds	Sidewalk	N/A	10	SF
G20 Site Improvements	G2040 Site Development	Building Exterior	Exterior Signage	N/A	1	EA
G20 Site Improvements	G2040 Site Development	Building Exterior	Mechanical Equipment Screens	N/A	10	SF
G20 Site Improvements	G2040 Site Development	Site & Grounds	Dumpster	N/A	1	EA
G20 Site Improvements	G2050 Landscaping	Site & Grounds	Exterior Drainage	N/A	1000	SF
G20 Site Improvements	G2050 Landscaping	Site & Grounds	N/A	Grounds	1000	SF
G30 Site Mechanical Utilities	G3090 Other Site Mechanical Utilities	Site & Grounds	Site Utilities	N/A	1000	SF
G40 Site Electrical Utilities	G4020 Site Lighting	Site & Grounds	N/A	N/A	1	EA

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
September 2011	Final	

4. TITLE AND SUBTITLE
Integration of Sustainment Management Systems (SMS) with the Army Installation Status Report for Infrastructure (ISR-I)

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
ITTP

6. AUTHOR(S)
Michael N. Grussing, Kelly M. Dilks, and Matthew C. Walters

5d. PROJECT NUMBER
FY10-12E

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Engineer Research and Development Center
Construction Engineering Research Laboratory
P.O. Box 9005
Champaign, IL 61826-9005

8. PERFORMING ORGANIZATION REPORT NUMBER
ERDC/CERL TR-11-38

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of the Assistant Chief of Staff for Installation Management (ACSIM)
Facilities Branch (DAIM-ODF)
2511 Jefferson Davis Highway
Arlington, VA 22202

10. SPONSOR/MONITOR'S ACRONYM(S)
ACSIM

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report describes the process for integrating the BUILDER Sustainment Management System (SMS) with the US Army Installation Status Report for Infrastructure (ISR-I). A common building component and assessment data framework between SMS and ISR-I was developed to link local facility condition and functional requirements managed through the BUILDER Sustainment Management System (SMS) to enterprise-level quality and mission metrics reported in the ISR-I. To accomplish this, the applicable facility components for all 63 ISR-I rating standards booklets were mapped to the corresponding BUILDER inventory items based on the UniFormat II classification system (ASTM E 1557-02). This data framework enables BUILDER to extract condition and functionality data from the ISR-I for certain building systems and components. It also establishes a foundation for uploading quality and mission capability ratings to the ISR-I for facilities that have been assessed using BUILDER. The outcome is a higher level of interoperability between the BUILDER SMS and ISR-I systems. BUILDER can use ISR-I condition data to drive the development of local installation annual work plans, and BUILDER-generated condition indices can feed ISR-I reporting requirements.

15. SUBJECT TERMS
BUILDER Sustainment Management System (SMS), Installation Status Report for Infrastructure (ISR-I), Sustainment, Restoration, and Modernization (SRM), facility life cycle, condition assessment, Army Real Property Database, UniFormat II

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified		40	